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The role of digital technology adoption in coping with SC disruptions caused by COVID-19 pandemic

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Abstract

Supply chain disruptions in addition to the immediate effect of stopping/ impeding the flows, long term effects can include bankruptcies, reduced business growth and increased business uncertainty. Unlike prior disruption events, the COVID-19 pandemic presents a novel opportunity to study a near-simultaneous global supply chain disruption. We carry out a systematic literature review to understand disruption response in this context.

Research Question

How has digital technology been implemented to mitigate supply chain disruptions caused by COVID-19?

Background

Industry 4.0 generally encompasses the implementation of technologies like:

- Internet of Things (IoT) e.g., Amazon Alexa, Philips Hue, Google nest,
- Cloud computing e.g. Google cloud, Microsoft Azure, Amazon cloud,
- Additive manufacturing e.g., Shapeways, Yeggi, Saab's use for aircraft fuselage repair,
- Block-chain: utilized in crypto-currency applications,
- Big-data: enterprise level applications, and
- e-Commerce in industry e.g., Amazon, e-Bay, Alibaba.com (Figure 1)

Supply Chain Disruption: COVID-19

- Supply chains are constantly exposed of elements of risk (Figure 2).
- Immediate effects: Firms having to move operations online or incorporate social distancing regulations over a matter of days (Table 1).
- Greatly reduced productivity - those firms that could successfully pivot to online operations were better able to sustain operations.

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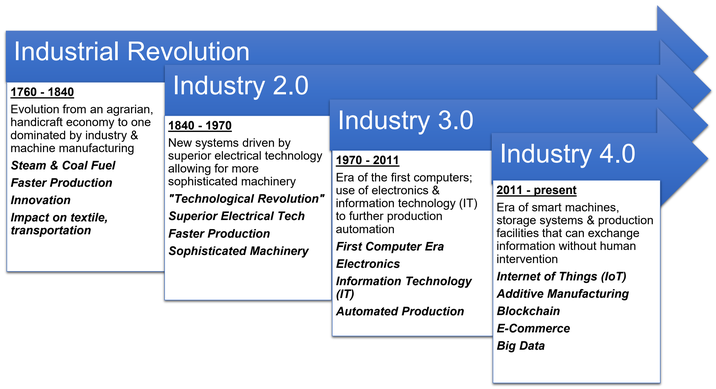

Fig. 1. Industry Evolution

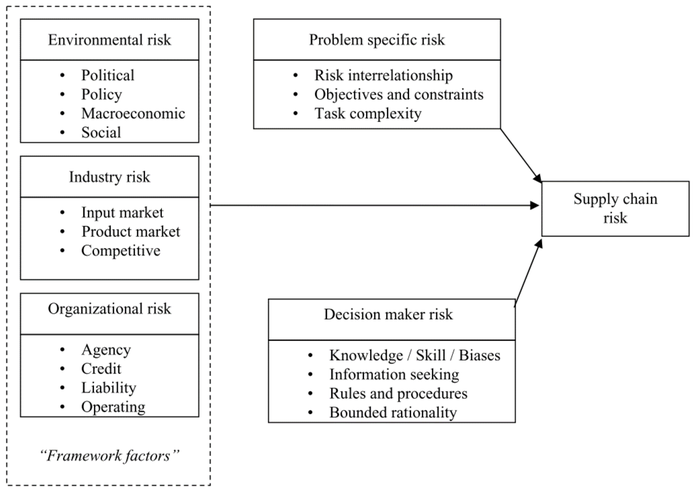

Fig. 2. Sources of Supply Chain Risk (Rao, & Goldsby, 2009)

Article	Key takeaways
Belhadi, A., Kamble, S., Jabbour, C. J. C., Gunasekaran, A., Ndubisi, N. O., & Venkatesh, M. (2021).	Preferred SC disruption mitigation strategies is industry driven
Gunessee, S., & Subramanian, N. (2020).	Ambiguity-coping mechanisms are also introduced as both individual and organizational strategies.
El Baz, J., & Ruel, S. (2021).	Need for relational governance with the SC members (suppliers, customers and other stakeholders).
Paul, S. K., & Chowdhury, P. (2020).	Model purportedly useful in addressing shortages in high-demand items, such as hand sanitizer and toilet paper. Authors deem prior models insufficient in this area.

Table 1. Select recent papers on COVID-19 effects on supply chain

Technology	Author	Main takeaway
Additive Manufacturing (AM)	Choong, Y. Y. C., Tan, H. W., Patel, D. C., Choong, W. T. N., Chen, C. H., Low, H. Y., ... & Chua, C. K. (2020).	3D printing offered resiliency in manufacturing networks during COVID-19.
	Kunovjanek, M., & Wankmüller, C. (2020).	Relieved stress on healthcare and manufacturing systems.
Block Chain	Nandi, S., Sarkis, J., Hervani, A. A., & Helms, M. M. (2021).	Block chain-enabled circular economy practices improves supply chain resiliency & stability during crises.
Big Data (BD)	Sheng, J., Amankwah-Amoah, J., Khan, Z., & Wang, X. (2020).	BD analytics frameworks mitigate impact of "black swan" supply chain disruptions.
E-commerce	Kim, R. Y. (2020).	e-Commerce capabilities will drive firms' digital transformation to recover/expand sales after COVID-19.
Artificial Intelligence	Nguyen, D., Ding, M., Pathirana, P. N., & Seneviratne, A. (2020).	Utilization of AI and block chain technologies to combat COVID-19.

Table 2. Select recent papers on COVID-19 effects mitigated by Industry 4.0 technologies

Methods

- A key-word search for COVID-19: operations and supply chain management discipline
- Thematic analysis
- Focus: the utilization of digital technologies associated with Industry-4.0 to aid business continuation during COVID-19. The selected outcome of this literature review is presented in Tables 1 & 2.

Key Take-aways/ Future Research

- Prima-facie, Industry 4.0 technologies have helped improve Supply Chain resiliency and implement risk mitigation strategies- with varying degrees of success
- Study requires further theoretical development through technology adoption frameworks such as Technology-Organization-Environment (T-O-E) and/ or Technology Adoption Model (TAM).

References

Belhadi, A., Kamble, S., Jabbour, C. J. C., Gunasekaran, A., Ndubisi, N. O., & Venkatesh, M. (2021). Manufacturing and service supply chain resilience to the COVID-19 outbreak: Lessons learned from the automobile and airline industries. *Technological Forecasting and Social Change, 163*, 120447.
Choong, Y. Y. C., Tan, H. W., Patel, D. C., Choong, W. T. N., Chen, C. H., Low, H. Y., ... & Chua, C. K. (2020). The global rise of 3D printing during the COVID-19 pandemic. *Nature Reviews Materials, 5*(9), 637-639.
El Baz, J., & Ruel, S. (2021). Can supply chain risk management practices mitigate the disruption impacts on supply chains' resilience and robustness? Evidence from an empirical survey in a COVID-19 outbreak era. *International Journal of Production Economics, 233*, 107972.
Gunessee, S., & Subramanian, N. (2020). Ambiguity and its coping mechanisms in supply chains lessons from the Covid-19 pandemic and natural disasters. *International Journal of Operations & Production Management*.
Kim, R. Y. (2020). The impact of COVID-19 on consumers: Preparing for digital sales. *IEEE Engineering Management Review, 48*(3), 212-218.
Kunovjanek, M., & Wankmüller, C. (2020). An analysis of the global additive manufacturing response to the COVID-19 pandemic. *Journal of Manufacturing Technology Management*.
Nandi, S., Sarkis, J., Hervani, A. A., & Helms, M. M. (2021). Redesigning supply chains using blockchain-enabled circular economy and COVID-19 experiences. *Sustainable Production and Consumption, 27*, 10-22.
Nguyen, D., Ding, M., Pathirana, P. N., & Seneviratne, A. (2020). Blockchain and AI-based solutions to combat coronavirus (COVID-19)-like epidemics: A survey.
Paul, S. K., & Chowdhury, P. (2020). A production recovery plan in manufacturing supply chains for a high-demand item during COVID-19. *International Journal of Physical Distribution & Logistics Management*.
Sheng, J., Amankwah-Amoah, J., Khan, Z., & Wang, X. (2020). COVID-19 Pandemic in the New Era of Big Data Analytics: Methodological Innovations and Future Research Directions. *British Journal of Management*.
Rao, S., & Goldsby, T. J. (2009). Supply chain risks: a review and typology. *The International Journal of Logistics Management*.